REMARKS

The Office Action dated June 1, 2004 has been reviewed carefully and the application has been amended in a sincere effort to place the application in condition for allowance. The Applicants would like to acknowledge with gratitude the Examiner conducting a telephonic interview with the Applicants' representatives on Tuesday, August 10, 2004.

Statement of the Substance of the Interview

In accordance with the Manual of Patent Examining Procedure Section 713.04, Applicants hereby submit the following Statement of the substance of the Interview conducted by telephone on August 10, 2004, by Examiner Alejandro with the undersigned as well as Mr. William W. Dailey. Esq., Assistant General Counsel of MTI MicroFuel Cells, Inc., the Assignee of the instant Application (the "Assignee") and Dr. Shimshon Gottesfeld, Chief Technical Officer of the Assignee, who are herein collectively referred to as Applicants' representatives:

The Applicants' representatives initially gave a brief summary of the main features of the present invention stating that the invention involves a simplified direct oxidation fuel cell system having a dead-ended anode chamber that does not require a recirculation loop. It was further discussed that in such a system, carbon dioxide must be released. Applicants system includes a gaseous effluent release port in the anode chamber for this purpose.

The distinctions over United States Patent Application No. US 2002/0172851 ("Corey") were discussed in that Corey, in the ordinary course of fuel cell operation, directs anodically generated carbon dioxide through a feature in a modified cell membrane and through the cathode chamber. This can aid in maintaining proper water balance within the fuel cell system, but calls for a significant modification of the membrane electrolyte available to achieve the required carbon dioxide permeability.

Independent claim 37 was specifically discussed. A proposed claim amendment was generally discussed wherein the gaseous effluent release port would be limited to being open and in substantially direct communication with the ambient environment. As used in the claims herein, "open" means capable of allowing gas, but not liquid, to escape from the anode chamber. Examiner Alejandro asked Applicants' representatives to point to an example of the open release port in the specification to which the representatives pointed to Fig. 6A as an example. The Examiner indicated that the Applicants representatives would have to show support for the limitation that the release port is "open" in the Specification. Applicants' representatives referred to page 14 of the Specification as filed for such support.

Following the discussion, Examiner Alejandro indicated that an amendment would require further consideration.

The discussion then turned to claim 56 which recites a gas permeable liquid impermeable layer coupled to the anode diffusion layer. This also related to the general question raised by the Examiner in the Office Action about whether the membrane electrolyte itself could function as a gas permeable layer. Dr. Gottesfeld pointed out that the

membrane electrolyte allows only a minimal amount of carbon dioxide to pass from the anode aspect of the fuel cell to the cathode chamber. Accordingly, using an unmodified membrane electrolyte would not be an effective way to encourage or manage release of the carbon dioxide out of the fuel cell in the present design.

The Examiner expressed agreement with this discussion by Dr. Gottesfeld, however, he indicated that the claim 56 does not recite that the layer is functioning to manage the release of carbon dioxide, and Applicants' representatives indicated that an amendment to include such a recitation would be made (and has been so made herein).

The outcome of the interview was that Applicants' representatives will submit a written amendment and a Request for Continued Examination (RCE) for further consideration in this regard. The present response includes such an amendment, and an RCE accompanies this response.

Election/Restrictions

The non-elected claims, i.e., Claims 47-54, 59-61, 64, 67 and 74-84, have been withdrawn herein.

New Claims

New Claims 85 – 102 have been added herein for consideration. No new matter has been entered.

Drawings

Applicants acknowledge the Examiner's indication that the proposed drawing corrections are acceptable. The officially corrected drawings are enclosed herewith.

Claim Rejections 35 U.S.C. § 112

Claim 42 was rejected under 35 U.S.C. § 112 as being dependent on a cancelled claim.

Claim 42 has been amended herein to depend upon claim 37.

Claim Rejections 35 U.S.C. § 102 (e)

Claims 37 – 46, 55 – 58, 62, 63, 65, 66, and 68 – 73 were rejected under 35 U.S.C. § 102 (e) as being anticipated by Corey et al. U.S. Patent Application No. US 2002/0172851 ("Corey"). Briefly, Applicants' invention is directed to a simplified direct oxidation fuel cell that includes a closed volume "dead-ended" anode chamber that does not require pumps and re-circulation loops. As will be understood by those skilled in the art, such a simplified system has the need for a mechanism for removal or release of anodically generated gaseous effluent, primarily, but not limited to carbon dioxide. The release of carbon dioxide is discussed as one of the objects of the invention in the Specification at page 4, beginning at line 28, which indicates that the system includes a simple fuel delivery system and further that: "This type of passive direct methanol fuel cell sys-

tem operation is also facilitated by the separation of gaseous carbon dioxide within the fuel cell, thus eliminating the requirement for at least one pump within the DMFC system."

Turning to the Detailed Description portion of the application, it states, *inter alia* that: "However, a direct methanol fuel cell may be simplified, in accordance with the present invention, by being constructed without the use of pumps if, in the first instance, the carbon dioxide is vented out of the system without having to circulate the fuel solution in which the carbon dioxide is contained. A schematic diagram of the invention which implements a carbon dioxide separator enabling such passive selective venting of carbon dioxide is set forth in Fig. 1A. (Specification, page 10, lines 19- 24)." This statement, and Fig. 1A, support the claim amendment that carbon dioxide (the "anodically-generated gaseous effluent") is effectively released from the gaseous effluent release port directly to the ambient environment (*See*: arrow labeled "CO2" leading from the anode chamber 18 directly to the ambient in Fig. 1A).

In accordance with one embodiment of the invention, the venting or release of carbon dioxide directly from the anode aspect of the fuel cell to the ambient environment is accomplished using a gaseous effluent release port located in the anode chamber or housing of the fuel cell system. In accordance with another embodiment of the invention, a gas permeable, liquid impermeable layer is placed in close proximity to the anode diffusion layer. In either case, as carbon dioxide is generated in the anodic reaction, the carbon dioxide is released to the environment through the gaseous effluent release port, or the gas permeable layer, and away from the membrane electrode assembly.

In the gaseous effluent release port embodiment, open gas permeable areas are fashioned in the anode housing. More specifically, the Specification states: "Two examples of this aspect of the invention are set forth in Fig. 6A and 6B. In Figs. 6A – 6B, the gas permeable layer areas are illustrated as windows 62 and 64 in Figs 6A and as port-holes 65 through 68 in Fig. 6B. *These gas permeable portions allow gaseous carbon dioxide to be removed from the fuel cell."* (Specification, page 14, lines 10 – 13) (Emphasis added) Thus the ports are fashioned as openings that are covered with a layer of a gas permeable, liquid-impermeable material and they allow the carbon dioxide to escape directly to the ambient environment from the anode chamber. Thus, there is no need that the ports are valved or that the carbon dioxide is pumped through a recirculation loop, and no such pumps or valves are mentioned. Thus, the carbon dioxide is released as it is generated because it is driven out of the port by the slight build up of gas pressure in the anode chamber.

Further support can be found in a number of statements in the Application about the importance of removal of carbon dioxide as it is generated and it being a part of passive system operation. One of the reasons that it is important to remove the carbon dioxide is to avoid a situation where gaseous effluent compromises the flow of reactants to the catalyzed membrane electrolyte, which could be avoided , for example, according to the Specificaion, when "the gas permeable membrane is in sufficiently close proximity that the carbon dioxide that passes through the anode diffusion layer can escape before the carbon dioxide molecules are able to coalesce and form large bubbles which could disrupt the flow of fluids in and around the fuel cell. The gas permeable membrane

draws the carbon dioxide gas generated in the anodic reaction away from the anode surface." (Specification, page 12, lines 16 – 22).

Accordingly, Applicants have cited several passages in the specification that indicate that carbon dioxide is vented out of the anode chamber of the fuel cell through the gaseous effluent release ports to <u>allow effective release of anodically-generated gaseous effluent from the fuel cell as the gaseous effluent is generated</u>. Thus Applicants respectfully submit that the amendment is fully supported by the Specification. No new matter has been entered.

Turning to the cited reference, briefly, the Corey system manages carbon dioxide by routing it through a feature in a modified membrane electrolyte and next through the cathode chamber targeting removal of excess water in the cathode chamber of the fuel cell. While providing a water control function, this approach requires a specialized modification of the cell membrane electrolyte or addition of a feature to the membrane electrolyte assembly because commercially available membrane electrolytes have very low carbon dioxide permeability that would not allow the release of the gaseous product at the rate required when the cell is operating normally. Corey is specifically directed to routing anodically generated carbon dioxide from the anode chamber through such a modified membrane electrolyte or feature and then through the cathode chamber, This is in contrast to Applicants' claimed invention in which the anodically generated gaseous effluent is released directly to the ambient environment from the anode chamber, thereby not requiring a special type of membrane electrolyte or a membrane electrolyte assembly

with a gas evolving feature, neither of which is commercially available. As stated, Applicants' invention releases carbon dioxide directly to the ambient environment, and not through the cathode chamber. Thus, Corey cannot be said to have anticipated the present invention as claimed.

In order to further clarify these distinctions that the present invention has over the cited reference and to further enhance the claims, independent claim 37 has been amended to positively recite that the fuel cell includes "at least one open gaseous effluent release port which is in substantially direct gaseous communication with the ambient environment allowing effective release of anodically-generated gaseous effluent from said fuel cell as said gaseous effluent is generated...." Therefore, it is respectfully submitted that claim 37 and the claims dependent therefrom are now in condition for allowance.

Specifically, claims 38 through 43 are dependent directly or indirectly upon claim 37 and for the reasons herein before stated, it is respectfully submitted that those claims are also now in condition for allowance.

Claim 44 has been amended to clarify that the gaseous anodic product removal component is disposed on the anode side of the housing for effective release of anodic product substantially directly to the ambient environment, and based on the foregoing comments, it is also respectfully submitted that that claim is now in condition for allowance.

Claim 45 has been amended to track the recited similar language as that added to claim 37 and based on the foregoing arguments it is also respectfully submitted that claim 45 is now in condition for allowance.

Claim 46 includes a means for outporting gases away from the anode aspect of the fuel cell which means for outporting gases is disposed in close proximity to said anode aspect of the catalyzed membrane electrode assembly. The claim has been amended herein to positively recite that the means for outporting gases away from the anode aspect of the fuel cell are in substantially direct communication with the ambient environment. It is respectfully submitted that claim 46 as amended is distinguishable from Corey in that those gases are directly released to the ambient environment and not through the cathode chamber via a modified membrane electrolyte or a feature in the membrane electrolyte assembly, as required by Corey.

Claims 47 through 54 were withdrawn in response to the restriction requirement and are so indicated in the status indicators.

With respect to claims 55 and 56, both claims contain an element recited as a gas-permeable, liquid-impermeable layer coupled to said anode diffusion layer. This gas-permeable, liquid-impermeable layer has the function of removing the gaseous anodic product, which is the carbon dioxide. The Examiner stated that it is noted that the membrane electrolyte 26 may act as the specific gas-permeable, liquid-impermeable layer coupled to the anode diffusion layer. This, however, is not the case as the membrane electrolyte is not sufficiently permeable to carbon dioxide to allow for effective removal of the carbon dioxide product from the anode chamber. Thus, the membrane electrolyte cannot function as a path by which anodically generated gaseous effluent can be removed from the fuel cell system, unless it is modified, as described in Corey. However, in order to clarify this aspect and to enhance claims 55 and 56, both claims have been amended to

state "a gas-permeable, liquid-impermeable layer for releasing gaseous anodic product coupled to said anode diffusion layer." This amendment positively recites that the layer is for releasing the gaseous anodic product and thus the membrane electrolyte could not function as such a layer. It is respectfully submitted that those claims are now in condition for allowance.

Claims 57 and 58 are dependent directly or indirectly on claim 56 and based on the amendments and arguments presented herein it is respectfully submitted that they are also now in condition for allowance. Claims 59 through 61 were withdrawn in response to the restriction requirement.

Claim 62 claims a direct oxidation fuel cell system which includes an element disposed between the fuel source and the anode aspect of the direct oxidation fuel cell for controlling the delivery of fuel to the membrane electrolyte. The anode chamber has no exit port for liquid. Corey does not disclose an element disposed between the fuel source and the anode aspect of the direct oxidation fuel cell for controlling the delivery of fuel to the membrane electrolyte and thus it cannot be said that Corey anticipates claim 62. Claims 63 through 73 depend directly or indirectly on claim 62 and are thereby also in condition for allowance.

Claims 74 through 84 were withdrawn in response to the restriction requirement and have been so indicated herein.

Summary

All of the objections and rejections presented by the Examiner in the Office Action dated June 1, 2004 have been addressed herein and it is respectfully submitted that the application is now in condition for allowance.

Please do not hesitate to contact the undersigned in order to advance the prosecution of this application in any respect.

Please charge any additional fee occasioned by this paper to our Deposit Account No. 03-1237.

Respectfully submitted,

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